Nebraska Public Power District
Gerald Gentleman Station

February 7, 2012

Scope Document

I. PROJECT

Perform an overall site water management and waste water treatment study associated with the Gerald Gentleman Unit 1&2 FGD and SCR retrofits.

II. SCOPE OF WORK

Background

S&L has performed several studies to date evaluating various treatment and recycle options for the FGD bleed stream (bleed stream flow ranging from zero to six gpm per unit). However, no studies have been performed to evaluate the recovery and reuse within the FGD system of existing plant wastewater streams that are currently routed to an evaporation pond. NPPD has indicated that future environmental regulations and the need for water conservation could mandate that these other wastewater streams be recovered and reused within the wet FGD system. This would require a specific plan for the recovery and possible treatment of these wastewater streams, and an evaluation of the impact of these streams (if any) on the FGD mass balance and overall station water balance.

Previous S&L studies have considered treatment options for the FGD bleed stream to achieve zero liquid discharge (ZLD). However, since the range of bleed rates and amount of bleed stream reuse within the fly ash damp unloading system depend on the the fuel sulfur and chlorine composition, a very limited number of ZLD options have been evaluated to date. NPPD has recently determined that the FGD program design basis, from a water use perspective, should be based on the lowest sulfur fuel, i.e. highest bleed rate, which will most likely require ZLD treatment for at least a portion of the bleed stream. Because of this, more ZLD options should be evaluated in a higher level of detail compared with previous S&L studies.

The following scope description is proposed to address the above issues:

1. Site Visit/Data Collection

S&L will schedule a two day visit to the Gerald Gentleman Station. The purpose of the site visit is threefold:

- Meet with the appropriate plant personnel in order to review the original Stearns Rogers water balance with respect to wastewater streams, routings and flow rates and obtain updated information based on changes that have occurred since the original plant design. (The Stearns Rogers water balance will be marked up during the meeting to document the discussion). It is understood that NPPD may provide S&L with operating data that could require further evaluation in order to update the water balance.

- Obtain any relevant wastewater quality data that will allow for determining if treatment is required prior to reuse within the FGD system.
- Perform a site walkdown to determine the best locations(s) for collection of the wastewater streams currently routed to the evaporation pond and a routing for returning these streams to the FGD system.

2. Station Water Balance and Waste Water Treatment Evalaution

After the site visit, S&L will use the marked up Stearns Rogers water balance to prepare a new set of water balances in Excel format. One water balance will depict the existing plant configuration, and the second water balance will depict the plant configuration with the future FGD and SCR additions and wastewater recovery.

Next, any wastewater quality data provided by the plant will be reviewed. This information will be used to develop a table documenting the flow rates and compositions of the various wastewater streams and to determine whether any treatment is required. Although the recovered wastewater streams constitute a small fraction of the total FGD makeup, it will be determined whether secondary oily waste treatment, neutralization, clarification and filtration, etc. of one or more wastewater streams would be justified. An additional FGD mass balance will be prepared based on the characteristics of the composite wastewater stream to determine if there is any impact on the flow rate or quality of the bleed stream.

After completion of the above, the previous ZLD system evaluations will be reviewed and updated. At a minimum, a formal evaluation of the HPD/Veolia *Cold Process* will be included, along with any additional evaporation, crystallization or other ZLD technologies, which appear reasonable and have proven experience.

Concurrent with the above evaluations, a conceptual design for the storage and return of plant wastewater to the FGD system will be developed. The location of storage facilities and the routing of wastewater piping will be marked on the site general arrangement drawing. The location of the recommended ZLD option and the routing of the distillate return will also be marked on the GA drawing.

3. Project Cost information

S&L will prepare a budgetary cost estimates (+/- 30%) for the storage, treatment (if any) and recovery of plant wastewater based on the recommended ZLD option.

4. Deliverables

S&L will prepare a draft and final study report including the following discussions and documentation:

- Discussion of current wastewater stream routings, flows and quality (where available)
- Discussion and comparison of alternate ZLD technologies
- FGD mass balance
- Station water balances
- Existing plant wastewater flow and quality data (if available)
- Conceptual design arrangement drawing
- Budgetary proposals for ZLD equipment
- Budgetary proposals for treating of existing plant wastewater (if applicable)
- Budgetary cost estimate

III. PROJECT MANAGEMENT

The following individuals shall be the primary contacts for the DISTRICT and the ENGINEER with respect to the performance of this TASK.

DISTRICT: John Meacham
ENGINEER: Paul Hoornaert

The study will be performed primarily by Michael Rosen who has been involved in the previous FGD wastewater evaluations for the Gerald Gentleman Project. A second engineer will accompany Mr. Rosen on the site visit and will assist in the walkdown and the preparation of the study report.

IV. SCHEDULE

The draft study report will be issued approximately six weeks after completion of the site visit. The final report will be issued within two weeks following resolution of all comments.

V. COMPENSATION

The study will be performed in 300 man-hours at a cost of $40,000 under the terms of our current general service agreement.

Travel expenses will be invoiced at actual cost.